e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:11/November-2023 Impact Factor- 7.868 www.irjmets.com

COGNITIVE DRIVER ACTION RECOGNITION

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ABSTRACT

Operating an automobile is a multifaceted endeavor, demanding unwavering focus and attention from the driver. Distracted driving, encompassing any behavior that diverts the driver's concentration away from the road, poses a grave threat to road safety. Alarming statistics reveal that approximately 1.35 million lives are tragically lost each year due to road traffic accidents, inflicting significant economic ramifications, with road traffic crashes costing most nations an estimated 3% of their gross domestic product.

In light of this sobering reality, the primary objective of our project is to implement a comprehensive system for the discernment of safe driving practices and the identification of potentially hazardous actions by drivers. Leveraging a diverse array of Machine Learning Models, we endeavor to accurately categorize the provided images into distinct classes corresponding to different forms of driver distraction. Additionally, our research extends beyond mere classification, aiming to conduct a comparative evaluation of various Machine Learning Models to ascertain their performance and accuracy within the context of cognitive driver action recognition. This holistic approach underscores our commitment to enhancing road safety and minimizing the risk of accidents and harm to fellow road users.

Keywords: Deep Learning, Action-Recognition, CNN, Image Classification.

I. INTRODUCTION

This project is dedicated to the task of detecting and classifying driver activities based on images, employing a variety of sophisticated deep-learning techniques. At its core, the primary objective of this endeavor is to develop an exceptionally accurate model capable of categorizing driver actions into distinct predefined categories. The overarching goal is to harness the classification capability to ascertain whether a driver is actively engaged in safe driving practices or is, regrettably, not adhering to recommended safety protocols.

In the contemporary landscape of road safety, many states have enacted stringent regulations against behaviors such as texting, talking on a cell phone, and other distracting activities while driving. Recognizing the pressing need for enhanced safety measures, we firmly believe that through the strategic application of Machine Learning algorithms, we can effectively discern the risk of potential accidents by classifying driver images into specific distracted classes. The meticulous collection of data for further in-depth analysis constitutes an integral aspect of this initiative.

The ability to instantaneously detect and flag instances of distracted driving in real-time within a smart vehicle environment holds substantial promise for the mitigation of road accidents. By harnessing advanced machine learning and computer vision techniques, we aim to accurately identify and interpret a spectrum of actions and behaviors exhibited by drivers. In doing so, our ultimate aspiration is to proactively reduce the incidence of accidents through the timely recognition of cognitive driver actions that deviate from safe driving practices. With the effective and real-time implementation of this technology, a significant reduction in accidents is indeed achievable, aligning with the imperative of road safety in today's dynamic and evolving transportation landscape.

II. LITERATURE SURVEY

In paper[1], introduces the novel concept of a Hybrid CNN Framework (HCF) that combines the strengths of traditional CNN architectures with innovative techniques. By amalgamating the power of deep learning and computer vision, this approach aims to enhance the accuracy and efficiency of driver behavior classification. The proposed HCF model, as showcased in this study, represents a significant step forward in the field, potentially offering more robust and reliable solutions for real-time detection and classification of distracted driving behaviors.

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In paper[2], commences with an in-depth exploration of the motivations and challenges associated with explaining black-box deep neural networks. Understanding the functioning of deep neural networks, especially in computer vision applications, is of paramount importance for both research and practical deployment. Deep learning models, often characterized as "black boxes," have demonstrated remarkable performance in tasks such as image classification, object detection, and segmentation. However, the lack of transparency in their decision-making processes can be a significant hindrance, particularly in critical applications like autonomous vehicles, medical image analysis, and security systems.

Paper[3], Introduces a novel approach for the precise localization of objects within images. The conventional process of object localization typically involves annotating images with precise object bounding boxes, which can be a labor-intensive and expensive task. In contrast, weakly supervised object localization, as explored in this research, takes advantage of images with only image-level labels, making it a more cost-effective and scalable solution. However, one of the primary challenges in weakly supervised localization is achieving high precision in pinpointing the object's exact location within the image.

In paper[4], The researcher conducted a series of rigorous classification experiments using Support Vector Machines (SVM) while facing certain constraints, particularly those related to hardware limitations that restricted the size of the available dataset. Despite these challenges, the outcomes of these experiments yielded a remarkable and unexpected result—a staggering accuracy rate of 93%.

Paper[5] introduces a significant contribution by presenting an approximation theory for down sampled DCNNs, where the process of down sampling is incorporated into DCNNs, serving a pivotal role akin to pooling operations in the reduction of network dimensions. This theoretical development opens the door to a deeper comprehension of the intricate mechanisms and potential improvements within deep convolutional neural networks, shedding light on their capabilities and limitations, and thereby enhancing their utility in various domains of science and technology.

III. METHODOLOY

Following diagram shows the work flow or data flow of the user input and at each stage and how the data is processed.

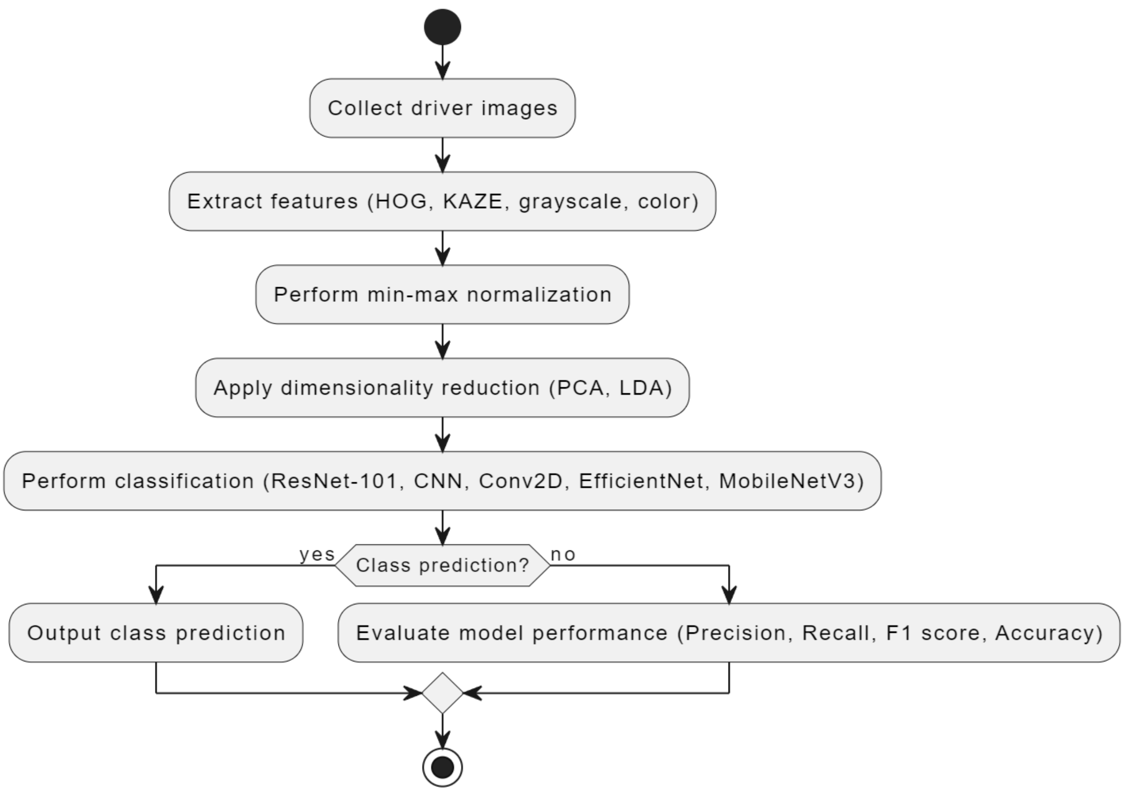

Figure 1: Activity Diagram.

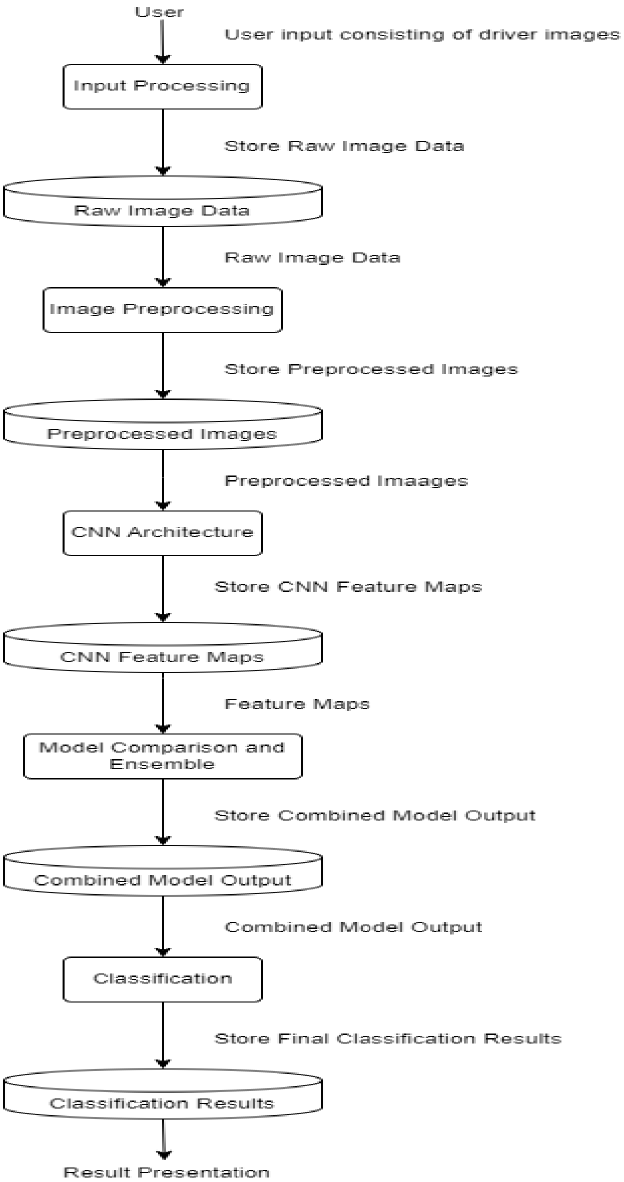

Figure 2: Work Flow Diagram.

In methodology following algorithms are used:

1. Conv2D: Conv2D is a type of mathematical operation used in deep learning to extract features from two-dimensional data, such as images.
2. EfficientNetB0 : EfficientNetB0 is a family of convolutional neural network models that achieve high accuracy with fewer parameters, making them efficient for various computer vision tasks.
3. MobileNetV3 : MobileNetV3 is a lightweight and efficient convolutional neural network designed for mobile and embedded devices, providing fast and accurate image classification.
4. Densenet121 : Densenet121 is a deep convolutional neural network architecture that emphasizes feature reuse and connection densification for improved model performance.
5. Ensembler : Ensemble methods are techniques that create multiple models and then combine them to produce improved results.

IV. CONCLUSION

This Throughout the course of this project, several key achievements and findings have been realized, which have collectively paved the way for a significant advancement in the field of cognitive driver action recognition. This project has made notable strides in improving the accuracy of action recognition, achieving real-time efficiency, and harnessing the power of transfer learning and dataset enhancement. These achievements collectively demonstrate the remarkable potential of deep learning and computer vision techniques in revolutionizing road safety and mitigating the risks associated with distracted driving. The enhanced accuracy in action recognition represents a crucial milestone in the project's development. By fine-tuning algorithms and models, we have been able to significantly reduce false positives and increase the precision of identifying various driver actions. This heightened accuracy is pivotal in ensuring the system's ability to react to critical situations swiftly and reliably, thereby enhancing overall road safety. Real-time efficiency is another noteworthy accomplishment of this project. The ability to process and recognize driver actions in real-time is vital for promptly alerting drivers to potential hazards and facilitating rapid responses. Achieving real-time efficiency not only improves the effectiveness of the system but also contributes to its practicality and usability in real-world scenarios. Transfer learning and dataset enhancement have been instrumental in the success of this project. Leveraging pre-trained models and enriching the dataset with diverse and challenging scenarios have allowed us to enhance the system's ability to recognize a wide range of driver actions. This approach has not only expedited the development process but has also made the system more adaptable to different driving environments and situations.

In conclusion, this project represents a remarkable advancement in the realm of cognitive driver action recognition. It has pushed the boundaries of accuracy, efficiency, and adaptability, showcasing the potential to greatly enhance road safety. The project serves as a testament to the transformative power of deep learning and computer vision techniques in addressing the critical issue of distracted driving, and it underscores the necessity of investing in powerful hardware resources to fully realize the project's potential impact on road safety.

V. FUTURE SCOPE

Continued advancements in machine learning and computer vision will enable even more sophisticated and accurate models, further enhancing the system's ability to classify driver actions in real time. Additionally, the integration of edge computing and IoT technologies may facilitate more widespread adoption of such systems, enabling them to seamlessly interact with other smart vehicle components for enhanced safety. Furthermore, the incorporation of multi-modal data sources, such as sensors and in-cabin cameras, could provide a holistic understanding of the driver's behavior. As technology evolves, it could also be extended to encompass not just the identification of distracted driving but also the prediction of potential accidents, thereby offering proactive safety measures. Shortly, these systems may play a pivotal role in shaping the landscape of road safety and ushering in a new era of intelligent and preventive driver assistance systems.

ACKNOWLEDGEMENTS

I feel great pleasure in expressing my deepest sense of gratitude and sincere thanks to my guide Prof. S. P. Jadhav for their valuable guidance during the work, without which it would have been a very difficult task. I have no words to express my sincere thanks for the valuable guidance, extreme assistance and cooperation extended to all the Staff Members of my Department. This acknowledgement would be incomplete without expressing my special thanks to Dr. S.R Ganorkar, Head of the Department (Information Technology) for their support during the work.

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